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Filed : November 30, 2001

### **REMARKS**

By way of summary, Claims 1-33 were pending in this application. Claims 1, 2, 13, 15, 27, and 28 are amended herein. Claims 16-17 and 31-33 are canceled. New Claims 34-39 are added. Accordingly, Claims 1-15, 18-30, and 34-39 remain pending for reconsideration.

This application is directed to a hard disk drive with unique shock event detection and data logging capability. As discussed in the previous response, moving parts of disk drives, which operate at small tolerances, are susceptible to unwanted physical contact when the disk drive experiences a shock event. Shock events can lead to damage, such as missed data retrieval, unintended overwrite of data in an adjacent track, or physical damage (such as to the disk surface) that results in permanent loss of data. Applicant has discovered a need for a shock detection system in hard disk drives that is able to aggregate and store data in a useful format, e.g., by incrementing one of a plurality of distinct bins, to improve diagnosis of a shock event. This capability can aid a technician monitoring a manufacturing process, a service provider servicing the disk drive, or a user by improving diagnosis of shock related damage to the disk drive.

#### **Allowed Claims**

Applicant thanks the Examiner for indicating that Claims 18-26 are allowed. Applicant agrees that the Examiner that the limitations of these claims are not taught or suggested by the prior art.

#### **Claims 1-10 Are Not Obvious In View Of Carlson And Kikuta**

The Examiner rejects Claims 1-10 under 35 U.S.C. § 103(a) as obvious in view of U.S. Patent No. 6,018,431 to Carlson et al. (Carlson) and U.S. Patent No. 6,510,014 to Kikuta et al. (Kikuta).

The Examiner relies primarily on Carlson, and correctly notes that Carlson does not teach a shock event logger. The Examiner asserts that Kikuta teaches this feature and asserts that it would have been obvious to combine Carlson and Kikuta because “it will provide the system taught by Carlson with the enhanced capability of being able to provide a correcting operation by a correction-value adjusting unit.” Office Action, page 2. The motivation to combine is not asserted as being found in either Carlson or Kikuta. Applicant disagrees with the Examiner’s

characterization of the references and with their combination. However, to expedite allowance of this application, claims have been amended to more clearly distinguish Kikuta, as discussed further below.

### **Kikuta and Carlson**

Kikuta shows in Figure 1 a disturbance detection circuit applied to a magnetic disk device. A shock sensor 1 detects a shock applied to the magnetic disk device as an analog electric signal. The signal is processed by various circuits and is compared with a threshold level by a component referred to as a “detection determining slice 5.” The detection determining slice 5 thereafter might generate a read/write operation inhibition signal 6 to inhibit a read/write (R/W) operation of the magnetic disk device. The shock sensor 1 also produces a shock analog signal 7 that includes shock information. This signal is sampled, as shown in Figure 1, and the scale or other component of the shock is obtained at a scale/component extractor 10. Kikuta also provides a generated history controller or manager 14 that stores information. Column 4, lines 53-63. The storage of information apparently is intended to provide feedback to the detection determining slice 5. See Figure 1. However, Kikuta does not teach or suggest incrementing one of a plurality of bins. In fact, Kikuta appears to teach away from incrementing one of a plurality of bins because the manager 14 records “a *cumulative total of the number of times* that the shock event occurs.” Column 4, lines 56-62. A cumulative total of the number of times that a shock event occurs would be recorded in a single bin.

As discussed above, Carlson does not teach or suggest a shock event logger of any kind.

### **Claims 1-9**

In contrast to Kikuta and Carlson, amended Claim 1 recites, among other limitations, a hard disk drive comprising:

a shock detection system that analyzes a signal indicative of a movement of at least a portion of the hard disk drive, determines whether the hard disk drive has experienced a shock event, and provides a shock event parameter based on the signal; and

a shock event logger that records the shock event parameter by incrementing one of a plurality of bins based on the value of the shock event parameter provided by the shock detection system....

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Kikuta and Carlson fail to teach or suggest at least these limitations of Claim 1. Accordingly, Applicant respectfully submits that Claim 1 is patentably distinguished over Kikuta and Carlson and requests allowance of Claim 1.

Claims 2-9 depend from Claim 1 and further define the invention defined in Claim 1. For at least the reasons set forth above with respect to Claim 1, Applicant respectfully submits that Claims 2-9 are patentably distinguished over Kikuta and Carlson. Claims 2-9 also are patentably distinguished over Kikuta and Carlson in view of the additional limitations defined in Claims 2-9. Therefore, Applicant respectfully requests allowance of Claims 2-9.

**Claims 11-15 And 27-30 Are Not Obvious In View Of Carlson, Kikuta, And Allen**

The Examiner rejects Claims 11-17 and 27-33 under 35 U.S.C. § 103(a) as obvious in view of Carlson, Kikuta, and U.S. Patent No. 6,115,200 to Allen et al. (Allen). Claims 16, 17, and 31-33 have been canceled as discussed above. Allen is relied upon as teaching the use of position error signals to determine a position deviation indicating a shock. Applicant notes that Allen is not relied upon as teaching a shock event logger of any kind and that Allen in fact does not provide any such teaching. Therefore, even if combined with Carlson and Kikuta, the shortcomings of Carlson and Kikuta remain, e.g., a lack of teaching of incrementing one of a plurality of bins based on the value of the shock event parameter.

**Claims 11, 12, and 14**

Claims 11, 12, and 14 depend from Claim 1 and further defines the invention defined in Claim 1. As discussed above, Allen does not affect the patentability of amended Claim 1 over Kikuta and Carlson. Thus, for at least the reasons set forth above with respect to Claim 1, Applicant respectfully submits that Claims 11, 12, and 14 are patentably distinguished over Kikuta, Carlson, and Allen. Claims 11, 12, and 14 also are patentably distinguished over Kikuta, Carlson, and Allen in view of the additional limitations defined in Claims 11, 12, and 14. Therefore, Applicant respectfully requests allowance of Claims 11, 12, and 14.

**Claim 13**

In contrast to Kikuta, Carlson, and Allen, amended Claim 13 recites, among other limitations, a hard disk drive comprising:

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a shock detection system that analyzes a signal indicative of a movement of at least a portion of the hard disk drive and determines whether the hard disk drive has experienced a shock event;

a shock event logger that records information about the shock event as determined by the shock detection system;

wherein the shock detection system comprises a position error signal processor that analyzes the position error signal indicative of a position deviation of the transducer from a reference position and determines that a shock event has occurred when the position error signal exceeds a predetermined threshold value of approximately 32% of a track width; and

wherein the shock event logger records the position error signal *by incrementing one of a plurality of bins based on the value of the position error signal*.

Kikuta, Carlson, and Allen fail to teach or suggest at least these limitations of Claim 13. Accordingly, Applicant respectfully submits that Claim 13 is patentably distinguished over Kikuta, Carlson, and Allen and requests allowance of Claim 13.

#### **Claim 15**

In contrast to Kikuta, Carlson, and Allen, amended Claim 15 recites, among other limitations, a hard disk drive comprising:

a shock detection system that analyzes a signal indicative of a movement of at least a portion of the hard disk drive and determines whether the hard disk drive has experienced a shock event;

a shock event logger that records information about the shock event as determined by the shock detection system;

wherein the shock detection system comprises a position error signal processor that analyzes the position error signal indicative of a position deviation of the transducer from a reference position and determines that a shock event has occurred when the position error signal exceeds a predetermined threshold value; and

wherein the shock event logger records position error signals corresponding to a plurality of shock events *by incrementing one of a plurality of bins based on the value of the position error signal*, the position error signal being recorded in a non-volatile memory.

Kikuta, Carlson, and Allen fail to teach or suggest at least these limitations of Claim 15. Accordingly, Applicant respectfully submits that Claim 13 is patentably distinguished over Kikuta, Carlson, and Allen and requests allowance of Claim 15.

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### **Claims 27-30**

In contrast to Kikuta, Carlson, and Allen, amended Claim 27 recites, among other limitations, a method of logging shock events in a hard disk drive comprising a rotatable disk having a magnetic recording media, the method comprising:

providing a shock event logger housed within the hard disk drive;

monitoring a signal from a component of the hard disk drive that responds to at least one of displacement, velocity, or acceleration of at least a portion of the hard disk drive;

providing a shock event parameter based on the signal to the shock event logger; and

*incrementing one of a plurality of bins based on the value of the shock event parameter.*

Kikuta, Carlson, and Allen fail to teach or suggest at least these limitations of Claim 27. Accordingly, Applicant respectfully submits that Claim 27 is patentably distinguished over Kikuta, Carlson, and Allen and requests allowance of Claim 27.

Claims 28-30 depend from Claim 27 and further define the invention defined in Claim 27. For at least the reasons set forth above with respect to Claim 27, Applicant respectfully submits that Claims 28-30 are patentably distinguished over Kikuta, Carlson, and Allen. Claims 28-30 also are patentably distinguished over Kikuta, Carlson, and Allen in view of the additional limitations defined in Claims 28-30. Therefore, Applicant respectfully requests allowance of Claims 28-30.

### **New Claims 34-39 Are Patentable**

New Claims 34-37 and 38-39 depend from allowable Claims 1 and 27 respectively. For at least the reasons set forth above with respect to Claims 1 and 27, Applicant respectfully submits that new Claims 34-39 are patentably distinguished over the prior art of record. Therefore, Applicant respectfully requests allowance of Claims 34-39.

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### CONCLUSION

For the foregoing reasons, the Applicant respectfully submits that the present application is in condition for allowance, and the Applicant respectfully requests that a Notice of Allowance be issued at the earliest opportunity.

Respectfully submitted,

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